

REMARKS

Claims 1-21 are pending in the case. All claims stand rejected. In the present submission, claims 1, 7, 10, 13 and 21 have been amended. Applicant has also amended the specification to update a reference to a related application and to correct a typographical error. Reconsideration is respectfully requested.

Objection to the Specification

The application has now been amended to update the reference to the related application in paragraph [0002]. Withdrawal of the objection to the specification is respectfully requested.

§101 Rejection

Claims 1-21 are rejected under 35 U.S.C. §101 because the claimed invention is directed to non-statutory subject matter. The Examiner contends that “claims 1-21 merely disclose steps of performing mathematical conversion in hardware without expressively disclosing a practical application or a tangible result.” Applicant respectfully traverses the rejection.

1. Applicable Law

35 U.S.C. §101 set forth four categories of subject matter for which a patent can be sought: processes, machines, manufacture and composition of matter. Although the Supreme Court held that Congress chose the expansive language of 35 U.S.C. §101 so as to include “anything under the sun that is made by man.” *Diamond v. Chakrabarty*, 447 U.S. 303, 308-09 (1980), patentable subject matter or statutory subject matter is subject to certain limits.

First, courts have found certain subject matter to be outside of, or exceptions to, the four statutory categories of inventions. It is now accepted that abstract ideas (such as mathematical algorithms), laws of nature and natural phenomena are not patentable or statutory subject matter.

However, a subject matter that involves the practical application or use of an idea, a law of nature or a natural phenomenon may constitute patentable subject matter. See, e.g., *Rubber-Tip Pencil Co. v. Howard*, 87 U.S. (20 Wall.) 498 (1874). See also, *MacKay Radio &*

Telegraph Co. v. Radio Corp. of America, 306 U.S. 86, 94 (1939) (“While a scientific truth, or the mathematical expression of it, is not patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be.”)

“It is now commonplace that an application of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection.” *Diamond v. Diehr*, 450 U.S. 175, 187 (1981). Thus, “[w]hile a scientific truth, or the mathematical expression of it, is not a patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be.” *Diehr*, 450 U.S. at 188 (quoting *Mackay*, 306 U.S. at 94).

For claims including such excluded subject matter to constitute statutory subject matter, the claimed invention as a whole must accomplish a practical application. That is, it must produce a “useful, concrete and tangible result.” See *State Street Bank & Trust Co. v. Signature Financial Group Inc.*, 149 F.3d 1368, 1373 (Fed. Cir. 1998). Accordingly, a complete disclosure should contain some indication of the practical application for the claimed invention.

In the Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility (22 November 2005, “the Guidelines”), the USPTO draws on extensive case law to establish a framework for determining whether a claimed invention is directed to statutory subject matter. Specifically, a claimed invention is directed to a practical application of a 35 U.S.C. 101 judicial exception when it:

- (A) “transforms” an article or physical object to a different state or thing; or
- (B) otherwise produces a useful, concrete and tangible result.

Under the physical transformation test, if the claimed invention provides a transformation or reduction of an article to a different state or thing, then the claim meets the statutory requirement of 35 U.S.C. §101. If the claim invention does not provide a physical transformation, the claim may still be eligible for patent protection if the claimed invention produces a useful, concrete, and tangible result. See, the Guidelines.

In determining whether the claim is for a “practical application,” the focus is not on whether the steps taken to achieve a particular result are useful, tangible and concrete, but

rather that the final result achieved by the claimed invention is “useful, tangible and concrete.” The claim must be examined to see if it includes anything more than a Sec. 101 judicial exception. If the claim is directed to a practical application of the Sec. 101 judicial exception producing a result tied to the physical world that does not preempt the judicial exception, then the claim meets the statutory requirement of 35 U.S.C. §101.

Even when a claim applies a mathematical formula, for example, as part of a seemingly patentable process, the claim may still be ineligible for patent protection if in reality it “seek[s] patent protection for that formula in the abstract.” *Diehr*, 450 U.S. at 191. One may not patent a process that comprises every “substantial practical application” of an abstract idea, because such a patent “in practical effect would be a patent on the [abstract idea] itself.” *Gottschalk v. Benson*, 409 U.S. 63, 71-72 (1972). See also, *Diehr*, 450 U.S. at 187, 209 USPQ at 8 (stressing that the patent applicants in that case did “not seek to pre-empt the use of [an] equation,” but instead sought only to “foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process”).

With regard to the “useful, concrete, and tangible result” requirement, an invention is useful if it satisfy the utility requirement of §101. That is, the utility of the invention has to be specific, substantial and credible. The tangible prone requires that the claim must recite more than a §101 judicial exception, in that the process claim must set forth a practical application of that §101 judicial exception to produce a real-world result. Finally, the concrete prone requires that a result can be substantially repeatable or the process must substantially produce the same result again. *In re Swartz*, 232 F.3d 862, 864 (Fed. Cir. 2000) (where asserted result produced by the claimed invention is “irreproducible” claim should be rejected under section 101).

With regard to computer-related inventions, several cases are of interest. In *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352 (Fed. Cir. 1999), claims drawn to a long-distance telephone billing process containing mathematical algorithms were held to be directed to patentable subject matter because “the claimed process applies the Boolean principle to produce a useful, concrete, tangible result without pre-empting other uses of the mathematical principle.” *AT&T*, at 1358. In the *AT&T* case, the claimed invention of the patent is “a message record for long-distance telephone calls that is enhanced by adding a primary interexchange carrier (“PIC”) indicator. The addition of the indicator aids long-

distance carriers in providing differential billing treatment for subscribers, depending upon whether a subscriber calls someone with the same or a different long-distance carrier...The PIC indicator therefore enables IXCs to provide differential billing for calls on the basis of the identified PIC.” *AT&T*, at 1353-1354.

In the *State Street* case, the court held that “transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces ‘a useful, concrete and tangible result’ – a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades.” *State Street*, 149 F.3d at 1373.

Finally, “when evaluating the scope of a claim, every limitation in the claim must be considered. The Examiner may not dissect a claimed invention into discrete elements and then evaluate the elements in isolation. Instead, the claim as a whole must be considered.” See, e.g., *Diamond v. Diehr*, 450 U.S. at 188-89 (“In determining the eligibility of respondents’ claimed process for patent protection under §101, their claims must be considered as a whole. It is inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis.”)

2. Claim 1 Recites a Practical Application

The claimed invention of claim 1 recites a device for a practical application of a mathematical function and is therefore directed to statutory subject matter under 35 U.S.C. §101. The claimed invention of claim 1 has substantial practical application in analog-to-digital conversion systems to enable digitized values from an analog-to-digital conversion process to be expressed in real world units. More specifically, the claimed invention of claim 1 is directed to a practical application of a mathematical function because it produces a useful, concrete and tangible result.

3. Claim 1 Recites a Useful, Concrete and Tangible Result

Claim 1 performs numerical value conversion of an N-bit digital input value in a first unit to generate a digital output value in a second unit being a natural unit. The problem solved by the claimed invention is to allow analog-to-digital converters or other systems to

generate digital output values that are expressed as real-world parameters. Applicant's specification, paragraph [0025], explains:

...applying the method and device of the present invention in an analog-to-digital converter provides particular advantages where conversion of the ADC results into natural units is often required. As mentioned above, ADC typically generates digital values in an arbitrary unit and **the digital values have to be converted into a real-world unit or a natural unit to be useful.** In the present description, **real-world units or natural units refer to units of physical measurement** such as degree Centigrade, volts, ampere, Decibels and watts. (Emphasis added.)

The conversion of a digital input value in an arbitrary unit into a digital output value in a natural unit is a useful, concrete and tangible result of the claimed invention.

Applicant's claimed invention is similar to the *AT&T* case and the *State Street* case both of which are well-known examples of inventions having a practical application because they produce useful, concrete, and tangible results.

In the *AT&T* case, the claimed invention of the patent is "a message record for long-distance telephone calls that is enhanced by adding a primary interexchange carrier ('PIC') indicator. The addition of the indicator aids long-distance carriers in providing differential billing treatment for subscribers, depending upon whether a subscriber calls someone with the same or a different long-distance carrier... The PIC indicator therefore enables IXCs to provide differential billing for calls on the basis of the identified PIC." *AT&T*, at 1353-1354.

In the *State Street* case, the claimed invention of the patent is directed to the "transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price." *State Street*, 149 F.3d at 1373.

Just as in the cases of *AT&T* and *State Street*, the claimed invention of claim 1 receives information (digital input value), processes the information (numerical value conversion) and generates a useful, concrete and tangible result in the form of a digital output value in a unit of physical measurement which may be stored and then used or relied upon by other systems or by users. Therefore, the claimed invention of claim 1 *as a whole* provides a useful, concrete and tangible result and accomplishes a practical application.

More specifically, the result of the claimed invention of claim 1 is a digital output value in a natural unit being a real-world parameter. The result of the claimed device is useful because it allows the digital output value to be readily interpreted by a user or by other systems. The digital output value is a digital value expressed in units of physical measurement such as degree Centigrade, volts, ampere, Decibels and watts. Therefore, the digital output value of the claimed device is a real world result and is tangible. Finally, the digital output value generated by the claim device is concrete as the result is repeatable and reproducible. That is, the numerical value conversion carried out in claim 1 will give the same digital output value for the same digital input value.

For the above reasons, claim 1 provides a useful, concrete and tangible result and recites statutory subject matter under 35 U.S.C. §101.

4. No Preemption

The claimed invention of claim 1 is directed to numerical value conversion from an arbitrary unit to a natural unit. The claimed invention does not cover every substantial practical application of the mathematical function in claim 1 and does not preclude the use of the mathematical function in other applications. In other words, the claimed invention of claim 1 does not attempt to claim the mathematical function in the abstract or to cover all possible use of the mathematical function. Rather, the claimed invention is directed to one specific and practical application of the mathematical function for performing numerical value conversion from an arbitrary unit to a natural unit. The claimed invention does not seek to preempt the use of the mathematical function in claim 1 but only sought to foreclose from others the use of the function in claim 1 in conjunction with all of the other steps in the claimed device, such as the use of a look-up table for storing coefficients for the conversion and the use of a first parameter to index the look-up table. For this additional reason, claim 1 is directed to statutory subject matter.

5. Claims 1-12 meet the Statutory Subject Matter requirement

The claimed invention of claim 1 receives information, processes the information and generates a useful, concrete and tangible result in the form of a *digital output value in a natural unit* which may be temporarily stored and then used or relied upon by a user or by other parts of a system. Therefore, the claimed invention of claim 1 *as a whole* provides a

useful, concrete and tangible result and accomplishes a practical application. Hence, claim 1 recites statutory subject matter under 35 U.S.C. §101.

Claims 2-12, dependent upon claim 1, recite statutory subject matter under 35 U.S.C. §101 for the same reasons as independent claim 1.

6. Claims 13-21 meet the Statutory Subject Matter requirement

For the same reasons stated above with reference to claim 1, the claimed invention of claim 13 receives information, processes the information and generates a useful, concrete and tangible result in the form of a *digital output value in a natural unit* which may be temporarily stored and then used or relied upon by a user or by other parts of a system. Therefore, the claimed invention of claim 13 *as a whole* provides a useful, concrete and tangible result and accomplishes a practical application. Hence, claim 13 recites statutory subject matter under 35 U.S.C. §101.

Claims 14-21, dependent upon claim 13, recite statutory subject matter under 35 U.S.C. §101 for the same reasons as independent claim 13.

7. Conclusion

For the reasons stated above, Applicant submits that claims 1-21 recite statutory subject matter under 35 U.S.C. §101. Withdrawal of the §101 rejection of the claims is respectfully requested.

§102 Rejection

Claims 1-5, 7-10 and 12-21 are rejected under 35 U.S.C. §102(b) as being anticipated by Kelly (U.S. Patent 5,942,992). Applicant respectfully traverses the rejection.

Kelly describes an engineering unit converter system for converting an analog measurement into an engineering value. The analog measurement is digitized and the digital value is split into a high order digital and a low order digit. "The high order digit is used as an address to a memory device for fetching a line segment coefficient and a line segment offset coefficient. The lower order digit is multiplied with the line segment coefficient in a multiplier resulting in a product. The product is added to the line segment coefficient offset

resulting in a sum whose value is an engineering unit.” (See Abstract of Kelly. See also Kelly, col. 4, ln. 42-54.) Kelly in col. 5, ln. 22-24 further describes the “high order bits 208 act as an address 212 and the low order bits 218 remain in a data state as a portion of the digital value 204 coming out of the ADC 202.”

Claim 1

Claim 1, as amended, recites:

1. A device for performing numerical value conversion of an N-bit digital input value in a first unit to a second unit being a natural unit, the first unit being related to the second unit by a first equation, comprising:

a memory having stored thereon a look-up table storing a plurality of coefficients for performing the numerical value conversion from the first unit to the second unit, **the look-up table being indexed using a first parameter** to provide a selected coefficient; and

an arithmetic logic unit receiving the N-bit digital input value in the first unit and the selected coefficient from the look-up table, the arithmetic logic unit performing the numerical value conversion based on the first equation and using the selected coefficient to compute a digital output value in the second unit. (Emphasis added.)

Claim 1 is patentable over Kelly at least by reciting “the look-up table being indexed using a first parameter” and “an arithmetic logic unit receiving the N-bit digital input value in the first unit.” In the claimed invention of claim 1, the look-up table storing the coefficients is indexed by a first parameter. While the first parameter may comprise the most significant k bits of the N-bit digital input value (see claim 10), the first parameter is not limited to being just the most significant bits of the digital input value. Kelly describes selecting coefficients for the engineering unit conversion using the high order bits as address. Kelly performs numerical value conversion only on the low order bits which are used as data.

To the contrary, the claimed invention of claim 1 uses a first parameter to select the coefficients and then the entire N bits of the digital input value is being processed to convert the N-bit digital input value to the digital output value in the second, natural unit. Kelly does not teach or suggest processing the entire N bits of the digital input value, as recited in claim 1. For at least these reasons, claim 1 is patentable over Kelly.

Claims 2-5, 7-10 and 12

Claims 2-5, 7-10 and 12, dependent upon claim 1, are patentable over Kelly at least for the same reasons that claim 1 is patentable.

Claim 8 is patentable over Kelly for the additional reasons that Kelly does not teach or suggest a first parameter being “a system operating condition associated with a system providing the digital input value,” as recited in claim 8. Claim 9 is patentable over Kelly for the additional reasons that Kelly does not teach or suggest a first parameter being “an operating temperature associated with the system providing the digital input value,” as recited in claim 9. Kelly only describes only the high order bits of the digitized value as the address to the coefficient table. Kelly mentions “converting temperature measurements into engineering units via thermocouples” (Abstract of Kelly). This is not the same as using the temperature as the index to the coefficient table. Kelly does not teach or suggest using an operating condition or an operating temperature as the address to the coefficient table. Throughout Kelly’s specifically, only the high order bits (e.g. Fig. 2A) or the high and the low order bits (Fig. 4) are used as addresses to the coefficient tables.

Claim 12 is patentable over Kelly for the additional reasons that Kelly does not teach or suggest “a multiplexor coupled to receive the first parameter and a second parameter,” as recited in claim 12. The Examiner states that “Kelly further discloses in Figures 1-7 a multiplexor...” (Office Action, p. 5). However, Applicant cannot find any reference to a multiplexor in Figures 1-7 or anywhere in Kelly’s specification. Kelly describes providing “the ability to simultaneously multiplex several transducers into a data acquisition system and simultaneously perform ‘real time’ conversion. This invention can simultaneously multiplex different transducer types or several identical transducer types, depending on the physical quantity being measured.” (Kelly, col. 3, ln. 33-38.) Figure 5 of Kelly describes a “pipeline method for enhanced speed” where simultaneous multiply and addition operations are being performed to double the speed of the conversion process. (See Kelly, col. 8, ln. 1-16.) Kelly is merely describing multiplexing of the digital input signals and using a pipeline address control to select the coefficients. Kelly does not teach or suggest providing a multiplexor to select a first parameter and a second parameter where one of the parameters is selected to address the coefficient look-up table.

Claims 13-21

Claim 13 is patentable over Kelly at least by reciting “indexing the look-up table using a first parameter to provide a selected coefficient” and “providing the N-bit digital input value and the selected coefficient to an arithmetic logic unit.” For the same reasons stated above with reference to claim 1, Kelly fails to teach or suggest addressing the coefficient table using a first parameter other than the most significant bits of the digital input value. Also, Kelly fails to teach or suggest providing all N bits of the digital input value for numerical value conversion.

Claims 14-21, dependent upon claim 13, are patentable over Kelly at least for the same reasons that claim 13 is patentable.

Claim 14 is patentable over Kelly for the additional reasons that Kelly does not teach or suggest “selecting the first parameter from a plurality of indexing parameters using a select input signal”, as discussed above with reference to claim 12.

Claims 19 and 20 are patentable over Kelly for the additional reasons that Kelly does not teach or suggest using a system operating condition or an operation temperature as the first parameter, as discussed above with reference to claims 8 and 9.

For the reasons stated, claims 1-5, 7-10 and 12-21 are patentable over the cited reference. Withdrawal of the §102(b) rejection of the claims is respectfully requested.

§103 Rejection

Claims 6 and 11 are rejected under 35 U.S.C. §103(a) as being obvious over Kelly. Applicant respectfully traverses the rejection.

Claims 6 and 11, dependent upon claim 1, are patentable over Kelly at least for the same reasons that claim 1 is patentable. The official notices taken by the Examiner do not cure the deficiency of Kelly. Claims 6 and 11 are therefore patentable over the cited reference and/or any official notice taken by the Examiner. Withdrawal of the §103(a) rejection of the claims is respectfully requested.

Double Patenting

Claims 1-5, 10, 13 and 20 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 6-10, 12 and 20 of

copending patent application serial no. 10/759,988. Applicant submits herewith a terminal disclaimer in compliance with 37 CFR 1.321(c). Withdrawal of the provisional double patenting rejection is respectfully requested.

CONCLUSION

Claims 1-21 are pending in the present application. Claims 1, 7, 10, 13 and 21 have been amended. The specification has been amended to correct typographical error and to update references to related application. No new matter has been entered. For the reasons stated above, the application is in condition for allowance and passage of the present case to allowance is respectfully requested. If the Examiner would like to discuss any aspect of this application, the Examiner is invited to contact the undersigned at (408) 382-0480.

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